

OUTLINE OF PROPOSED WORK TO ADDRESS
PCB CONTAMINATION IN TWELVE MILE CREEK
AND HARTWELL LAKE

Background information concerning PCB contamination in Hartwell Lake has been discussed earlier by parties involved in development of proposed work required to gain information needed for remedial action and will not be restated in this outline. However, I would like to point out that PCB concentrations in fish in Hartwell Lake are considered to be extreme when compared to levels found at most sites around the country. This in itself should be considered during planning. In addition to studies required for remedial action, there is opportunity to determine effects of PCB contamination on fish health that would be difficult under marginal contaminant levels. Portions of the proposed studies might be considered research but also are needed for environmental risk assessment that can be applied at Hartwell and nationally. Additionally, trend monitoring is needed for evaluation of remedial action at a heavily contaminated site. This would have national implications as well as supplying information required for decisions concerning management of the Hartwell site.

The goal of the proposed biological investigations is to collect information required for remediation of existing contamination problems for Operational Unit Two (OU 2). The primary objectives of these investigations include: 1) providing information concerning the extent and magnitude of contamination in the aquatic biota, 2) providing information to assess human health risk and risk to the aquatic biota, and 3) providing information that will lead to corrective action, protect human health and protect the aquatic environment.

Evaluation of the biological component of the OU 2 site will be separated into two areas. Information concerning the biota in Twelve Mile Creek is lacking and requires screening studies to determine the nature, extent, and effects of contamination of the aquatic environment. Historical information concerning contamination in Hartwell Lake is available. Therefore, planning for Twelve Mile Creek and Hartwell Lake will be outlined separately.

TWELVE MILE CREEK

Initial studies in Twelve Mile Creek will be conducted during fall 1991 to: 1) determine the concentration of PCB's in one primary fish species (bluegill or redbreast sunfish) and one species of turtle, 2) assess effects of PCB contamination on the fish community by determining the Index of Biotic Integrity (IBI), 3) assess effects of PCB contamination on the macroinvertebrate community using Benthic Rapid Bioassessment techniques, 4) assess fish health of a selected species (bluegill or redbreast sunfish)



using Bioindicators and Health Assessment Index (HAI), and 5) determine needs for further investigations.

Five stations will be established in Twelve Mile Creek. Station 1, upstream from the point source or other suitable site will be used as a reference site. Station 2 will be located downstream from the point source at a distance that should not be affected by movement of fish into and out of the uncontaminated upstream areas. Station 3 will be located near mid point between the point source and Hartwell Lake. Station 4 will be located above the upper most pond formed by the Central Easley Water Works Dam. Station 5 will be in the middle pond formed by the Woodside 1 Dam at Cateechee, South Carolina. These stations are required to show a gradient of PCB contamination and determine if degradation or recovery of the aquatic biota in Twelve Mile Creek from the point source to Hartwell Lake has occurred.

Site selection for stations 1 through 4 will be completed during summer 1991. Site selection for IBI studies are critical to ensure habitats between stations are similar. This ensures comparisons are between fish communities and do not reflect differences based on available habitat. Station 5 will not be included in the IBI.

Index of Biotic Integrity

The IBI will be used to assess the general health of the fish community in Twelve Mile Creek. This index is based on a set of metrics determined from species composition and abundance for a fish community. These metrics focus on basic ecological characteristics of the fish fauna and have been used effectively in stream monitoring programs for the past decade. Samples will be collected at stations 1 through 4.

PCB Contamination Study

STRATIFYING → MOD BOTTOM "FORAGE" FISH

Ten fish will be collected from each station for contaminant studies. Because this is a screening study and there is little information concerning use of the fishery resource in Twelve Mile Creek, initial efforts will concentrate on the need to determine PCB concentrations in fish that are consumed (cleaned fish). Bluegill or redbreast sunfish are expected to be used as the target species for these investigation. This will be based on availability and size of these species in Twelve Mile Creek. These were chosen based on expected abundance, and likelihood of use by anglers.

USE SKIN-ON FILLETS -

Fish used for contaminant studies will be prepared for analysis in a manner that anglers would be expected to clean their catch. For sunfish, this is whole body, scaled with head and viscera removed. Ten fish will be analyzed for PCB Aroclors and total PCB's for each station. Total number of fish for PCB analysis for Twelve Mile Creek is 50.

Five turtles will be collected at each station for PCB contaminant studies. Turtles were selected to ensure detection of

(DELETE TURTLES)

MOD ~~BOTH~~ WHAT BOTTOM BOTTOM FEEDERS

PCB's in Twelve Mile Creek because they are typically long lived and are expected to bioaccumulate PCB at higher concentration than fish.

Turtle flesh samples will be prepared for PCB analysis to include Aroclors. A total of 25 turtles will be analyzed from Twelve Mile Creek.

Fish Health

The Health Assessment Index (HAI) will be used to assess the health of a target fish population. It is an autopsy based index that uses divergence from normal of various organs, tissues, and blood parameters to assess fish health. This is not a diagnostic tool but has been proven effective in identifying health problems related to environmental degradation by assessing the effects of stress on the health and condition of fish. Initial sampling will be conducted to identify health problems and establish baseline information. This technique will be employed because it has thus far been proven to be accurate and is a cost effective way for long term monitoring for fish health. Following sampling, results can be determined on site within hours.

Fifteen fish (bluegill or redbreast sunfish) will be analyzed at each station. Ten of these will be used for the contaminant analysis described above. Each fish will be individually tagged with a numbered code allowing relationships between health and contaminant levels to be determined.

Bioindicators are diagnostic in nature and will be used in the initial investigations to establish baseline information and establish relationships between fish health and PCB concentrations in fish. Selected bioindicators identified during studies conducted in Hartwell Lake in spring 1990 will be used. These include measuring selected enzymes levels that indicate health problems like organ dysfunction that can be related to PCB concentrations in the fish. These analyses will be used for environmental risk assessment and maybe important in assessing remedial action.

Blood and tissue samples required for bioindicator analysis will be collected from the same 15 fish used for the HAI at each station. A total of 75 fish will be sampled for bioindicator analysis at all five stations. Relationships between contaminant levels, HAI, and fish health will be determined.

Otoliths will be collected from the 60 fish used for the fish health assessment studies to determine the age of each fish. Age can be a factor in both fish health and contaminant levels. Individual number codes will be assigned to each otoliths corresponding to those used for other analysis.

Macroinvertebrate Community

Benthic Rapid Bioassessment techniques will be used at stations 1 through 4 in Twelve Mile Creek and the reference site to assess the

effects of PCB contamination on the benthic macroinvertebrate community. Sample size appropriate for the family level protocol will be used.

Assessment of Resource Use

There is little information concerning use of the fishery in Twelve Mile Creek. Interviews of local residents around the Cateechee, South Carolina area indicate that locals residents harvest and consume fish and other aquatic animals from the creek. It can also be seen at access points that fishing does occur. To gain information concerning use we could use one of three survey techniques: 1) creel survey, using an active creel clerk to travel along the creek interviewing individuals, 2) mail survey, by distributing survey forms by rural route carriers to box holders in the area of interest, and 3) telephone interview, within the area of interest. At this point, I am open to suggestions and can collect this information with any of these techniques. The creel survey would provide the most information. However, it would be difficult along this creek and maybe the most expensive.

Any additional investigations required for Twelve Mile Creek will be based on findings of the current screening studies.

PLANNED WORK FOR HARTWELL LAKE

Six stations will be established in Hartwell Lake to show a gradient of PCB contamination in fish and establish a reference site. These stations will remain consistent with those historically sampled by the South Carolina Department of Health and Environmental Control (DHEC). Although species collected, sample preparation, and stations sampled were not consistent for all years and analysis was not conducted for all years, this will allow a continuation of the DHEC data base established since 1976. Additionally, stations established by DHEC are appropriate to meet the objectives of these investigations.

Station SV-107 is located in the Twelve Mile Creek embayment (figure 1). This is the most heavily contaminated area in Hartwell Lake. Station SV-106 is located at the confluence of Hartwell Creek and the Seneca River. This station has not been sampled consistently but is needed for trend analysis. Station SV-532 is located on the main channel of the Seneca River at the confluence of 18 Mile Creek. PCB levels in fish often remain above 2 mg/l at this station. Station SV-535 is located near Andersonville Island at the confluence of the Tugaloo and Seneca Rivers. PCB levels in most species are below 2 mg/l at this station. Station SV-642 is the most downstream site located near Powder Bag Creek. PCB Levels have typically been less than 1 mg/l at this station. Station SV-641 is located in the Tugaloo River near where Interstate 85 crosses the river. This will be used as a reference site. These stations will be used to

INPUT FROM ICF NEEDED HERE
WHAT TO GAIN FROM THE MACRO-STUDY
WHY DO WE NEED THIS INFO?

ADD STATIONS WHERE SEDIMENTS SHOW
CONCENTRATIONS.

ADD BIOASSAY DISCUSSION - BECHTEL COLLECT
- TISSUES ANALYZE.

USE
CREEL SURVEY
DURING
SUMMER 91

ATTACH ICF'S DISCUSSION
OF ECOLOGICAL DATA NEEDS

establish trend monitoring for fish health and PCB concentrations in fish.

During spring 1991 ten largemouth bass, ten black crappie, ten hybrid bass, and four channel catfish will be collected at each station for PCB analysis. Sample sizes are based on analysis of variability within historic samples for each species. Standard fillets will be prepared by removing scales with skin on including rib cage and belly flap. Total number of fish to be analyzed for PCB's and Aroclors is 204. However, work proposed for spring 1992 will include fish health assessment that requires additional contaminant analysis on the target species (LMB) to ensure interpretation of causes of poor condition or health can be related to PCB contamination. Therefore, the ten LMB to be analyzed at each station should be analyzed for the priority pollutants. This information should also prove to be valuable when dealing with public concern and allow early detection of additional contaminant problems in Hartwell Lake. Priority pollutant analysis is proposed as a one time analysis unless significant levels of contaminants other than PCB's are identified. Total number of LMB to be analyzed for priority pollutants is 60.

²34
x 6
204

WHOLE BODIES
NEEDED FOR
ECO R.A. ?
ADDITIONAL
SPECIES.
ADD ICF'S
DATA NEEDED IN
APPENDIX

Additionally, the South Carolina Wildlife and Marine Resources Department has collected flesh samples from 20 walleye during spring 1991. This species is currently being evaluated to determine if annual stocking in Hartwell Lake is warranted to make this a viable fishery. Determination of the levels of PCB's in these samples may be important in decisions concerning any stocking program and may head off any potential conflicts between fisheries management and contaminant remediation. This is currently planned as a one time analysis.

To determine PCB concentrations in forage species, five composite samples of five fish each will be collected for two size classes for each species including juvenile and adult threadfin shad, juvenile and adult gizzard shad, juvenile and adult bluegill, and, if available, juvenile and adult blueback herring at stations SV-107, SV-532, and SV-641. Total number of samples is 40. To facilitate collection of forage species and provide population information required for assessment of environmental risk, these fish will be collected during summer 1991 using standard cove rotenone techniques.

PROPOSED BIOLOGICAL WORK FOR SPRING 1992 IN HARTWELL LAKE

Contaminant Analysis

^{WILL} Contaminant analysis for PCB's at the six stations in Hartwell Lake should be completed for the same species and sample sizes as proposed for 1991 samples. In addition, investigations during spring 1990 showed fewer LMB over age 5 at SV-107 than at other sites. This suggests additional investigations of older age fish are warranted.

Ten LMB of size classes above the standard of 1.5 to 3 pound range normally used for LMB will be collected to correlate between age/size and PCB levels. The total number of fish to be analyzed for PCB's is 214 which includes the ten addition LBM from the Twelve Mile Creek embayment.

Fish Health Assessment

The health of a target fish population (LMB) will be determined using selected bioindicators and the HAI at the six station in Hartwell Lake. These data are needed for environmental risk assessment and baseline information for monitoring remedial action.

Thirty LMB (15 male and 15 female) will be analyzed per station. The same fish will be used for both techniques. Five of each sex will be used for the PCB contaminant analysis. Relationships between fish health determined with bioindicators, the HAI, and contaminant levels will be determined. *MONEY-SAVING TECHNIQUE*

Largemouth Bass Reproduction

Based on the findings of the population and reproductive studies conducted on LMB during spring 1990, investigations concerning affects of PCB's on reproduction and early life history are warranted. The literature also indicates that effects of PCB's on fish populations may be concentrated at the early life history stages including hatching success and larval survival. During spring 1992, comparisons will be made between egg fertilization success, hatching success, and larval survival between contaminated and non-contaminated areas of the reservoir. These experiments will be conducted at stations SV-107, SV-532, and SV-641. Additionally, laboratory tests of embryo and larval survival in water and sediment collected from these three stations will be conducted. *MORE DETAIL NEEDED! OAK RIDGE NATIONAL LAB. SEEMS HIGH RISK AS COMPILED. POSSIBLY CONDUCT IN LAB.*

Assessment of Resource Use

Information concerning utilization of the fishery resource in Hartwell Lake is needed to quantify risk to human health and may be important for remedial action by providing information required for managing fish consumption in designated areas within the reservoir.

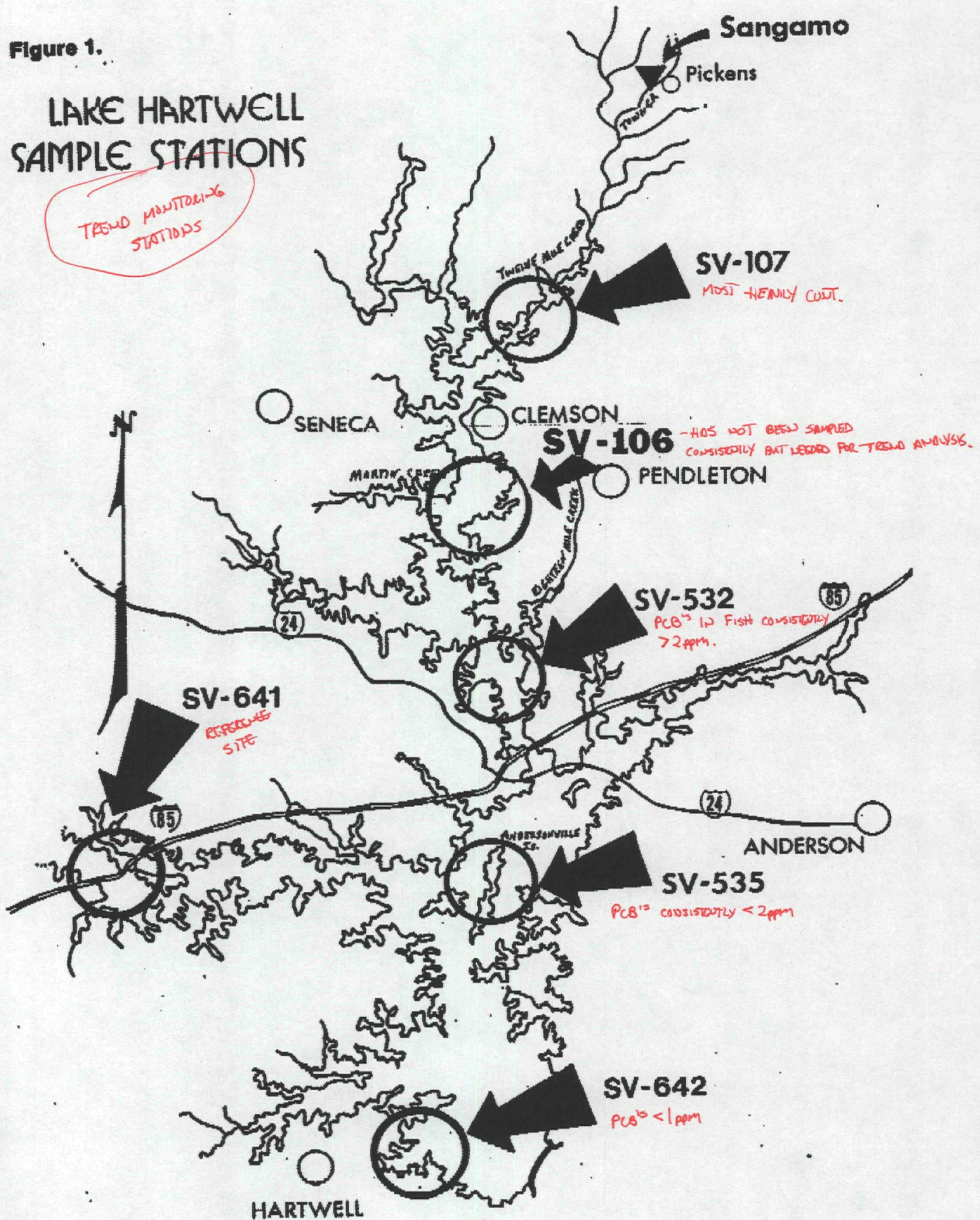
In Hartwell Lake this information can be best obtained by using a roving creel survey. This would provide information about harvest by species, size, area, etc. In addition, with a specially designed survey, information concerning PCB contamination can be collected. If remedial action requires management i.e. public advisories, or regulations restricting harvest. Questions that can become important can be included in the survey. An example would be "Are you aware that Hartwell Lake has levels of PCB's in fish that warrant public advisories not to eat fish from this area?" I propose we conduct a specially designed five year creel survey to ensure we maintain sufficient information to allow decisions concerning use and management of these resources.

Additional information concerning fishery use will be incorporated into these investigations. The Georgia Department of Natural Resources, South Carolina Wildlife and Marine Resources and the U. S. Army Corps Of Engineers is conducting a three year LMB tagging study in Hartwell Lake to determine exploration of these stocks. They have divided the reservoir into eight areas that will provided information concerning harvest of LMB in contaminated and non-contaminated area and allow comparisons between length frequency data between areas. These data may be important in determining if differences in the abundance of large LMB between the 12 Mile Creek embayment and other sites sampled in spring 1990 were affected by harvest or chronic mortality due to stress resulting for PCB contamination.

-INFO. OF ANGLER CONSUMPTION.

-LIST OF " ? " IN W.P.

Figure 1.

LAKE HARTWELL
SAMPLE STATIONSTREND MONITORING
STATIONS

SPRING 1991		SUMMER 1991		FALL 1991		WINTER 1992		SPRING 1992	
SV-107	Site Location			Twelve-Mile Creek	BEGIN CREEK	SV-107			
10 LMB - PCB &	Stations 1-4				SURVEY	20 LMB	PCB	HAI - 30 LMB	
Priority Pollutants	Twelve-Mile Creek			STATION 1		10 B. Crappie	PCB	Bioindicators - 30 LMB	
10 B. Crappie				10 Fish	PCB	10 Hybrid Bass	PCB	LMB Reproduction	
10 Hybrid Bass	Cove Rotenone PCB's			5 Turtle	PCB	4 C. Catfish	PCB		
4 C. Catfish	and Population Studies			HAI					
				Bioindicators		SV-106			
SV-106	SV-107			Benthic Rapid		10 LMB	PCB	HAI - 30 LMB	
10 LMB - PCB &	Composite Samples			Bioassessment		10 B. Crappie	PCB	Bioindicators - 30 LMB	
Priority Pollutants	5 Juvenile Threadfin Shad	5 Juvenile Bluegill		IBI		10 Hybrid Bass	PCB		
10 B. Crappie	5 Adult Threadfin Shad	5 Adult Bluegill				4 C. Catfish	PCB		
10 Hybrid Bass	5 Juvenile Gizzard Shad	5 Juvenile Blueback Herring		STATION 2					
4 C. Catfish	5 Adult Gizzard Shad	5 Adult Blueback Herring		10 Fish	PCB	SV-532			
				5 Turtle	PCB	10 LMB	PCB	HAI - 30 LMB	
SV-532	SV-532			HAI		10 B. Crappie	PCB	Bioindicators - 30 LMB	
10 LMB - PCB &	Composite Samples			Bioindicators		10 Hybrid Bass	PCB	LMB Reproduction	
Priority Pollutants	5 Juvenile Threadfin Shad	5 Juvenile Bluegill		Benthic Rapid		4 C. Catfish	PCB		
10 B. Crappie	5 Adult Threadfin Shad	5 Adult Bluegill		Bioassessment					
10 Hybrid Bass	5 Juvenile Gizzard Shad	5 Juvenile Blueback Herring		IBI		SV-535			
4 C. Catfish	5 Adult Gizzard Shad	5 Adult Blueback Herring				10 LMB	PCB	HAI - 30 LMB	
				STATION 3		10 B. Crappie	PCB	Bioindicators - 30 LMB	
SV-535	SV-641			10 Fish	PCB	10 Hybrid Bass	PCB		
10 LMB - PCB &	Composite Samples			5 Turtle	PCB	4 C. Catfish	PCB		
Priority Pollutants	5 Juvenile Threadfin Shad	5 Juvenile Bluegill		HAI					
10 B. Crappie	5 Adult Threadfin Shad	5 Adult Bluegill		Bioindicators		SV-642			
10 Hybrid Bass	5 Juvenile Gizzard Shad	5 Juvenile Blueback Herring		Benthic Rapid		10 LMB	PCB	HAI - 30 LMB	
4 C. Catfish	5 Adult Gizzard Shad	5 Adult Blueback Herring		Bioassessment		10 B. Crappie	PCB	Bioindicators - 30 LMB	
				IBI		10 Hybrid Bass	PCB		
SV-642						4 C. Catfish	PCB		
10 LMB - PCB &				STATION 4					
Priority Pollutants				10 Fish	PCB	SV-641			
10 B. Crappie				5 Turtle	PCB	10 LMB	PCB	HAI - 30 LMB	
10 Hybrid Bass				HAI		10 B. Crappie	PCB	Bioindicators - 30 LMB	
4 C. Catfish				Bioindicators		10 Hybrid Bass	PCB	LMB Reproduction	
				Benthic Rapid		4 C. Catfish	PCB		
SV-641				Bioassessment					
10 LMB - PCB &				IBI					
Priority Pollutants									
10 B. Crappie				STATION 5					
10 Hybrid Bass				10 Fish	PCB				
4 C. Catfish				5 Turtle	PCB				
				HAI					
				oindicators					